Chemistry of Natural Compounds, Vol. 34, No. 6, 1998

AN INVESTIGATION OF THE CHANGE IN NITROLIGNIN DURING MECHANICAL TREATMENT

Kh. A. Abduazimov, É. L. Kristallovich,
and Kh. N. Aripov*

UDC 693.0.864.9

It is known that the mechanochemical treatment of some drugs increases their solubility and biological activity, and ensures their prolonged action [1].

In the present communication we discuss the results of the mechanochemical treatment of nitrolignin (NL) obtained by nitrating hydrolysis lignin with nitric acid [2] in an Gefest AGO-2U (D-109) planetary-centrifugal grinder-activator.

The NL that we obtained had the following elementary composition, %: C 47.17; H 4.90; N 2.80; OCH_3 1.23. The composition of the NL after the D-109 treatment was, %: C 46.08; H 4.68; N 2.78; OCH_3 1.03.

In a comparison of the IR spectra of the NL before and after treatment in the D-109 grinder-disintegrator we detected an appreciable increase in the intensity of the maximum resulting from the stretching vibration of the OH group (3340—3370 cm^{-1}) and a fall in the intensity of the absorption band at 1060 cm^{-1} corresponding to the stretching vibrations of C—O—C ether bonds. This experimental fact permitted the assumption of a breakdown of hydrogen bonds and also a possible partial demethylation of the nitrolignin subjected to mechanochemical action [3, 4].

In the IR spectrum of a composition of the NL with urea (1:1) obtained in the D-109 disintegrator, new absorption bands — $\nu_{C=O}$ at 1687 cm^{-1} and an intense broad maximum at 3457 cm^{-1}, absent from NL and urea — had appeared. Moreover, in the IR spectrum of the composition of the NL with urea an appreciable fall in the intensity of an absorption band in the 2300—2550 cm^{-1} region assigned to NH···OH chelate bonds was observed.

The change in characteristic frequencies is probably explained by the participation of the proton-donating OH groups of the nitrolignin and NH_2 groups of the urea with the proton-accepting C=O centers of the urea and the NL with the formation of hydrogen bonds (HBs) (OH···O=C, NH···O=C) in the NL—urea composition. At the same time, the participation of water of hydration in the formation of OH···O=C HBs is not excluded.

Thus, on the basis of IR spectral characteristics of NL and urea and the NL—urea composition we have shown the most probable mechanism of the formation of a complex of NL with urea. The NL—urea complex obtained chemically shows a higher solubility in alkalies and an increased growth activity as compared with the initial components.

REFERENCES

1. S. S. Khalikov and Kh. N. Aripov, in: Abstracts of Lectures at an International Conference on Polymeric Preparative Forms of Chemical Plant-Protecting Agents and Their Use in Seed-Growing [in Russian], Tashkent (1996), p. 21.
2. D. T. Zabramnyi, A. T. Tadzhiev, et al., USSR Inventors' Certificate No. 812961/23 of 1965.
3. O. U. Sisask, A. S. Arshanitsa, B. M. Kipnis, M. F. Gromova, and E. A. Chirkova, in: Abstracts of Lectures at the VIIth All-Union Conference on the Chemistry and Use of Lignin [in Russian], Riga (1987), p. 130.
4. S. A. Saidalimov, L. S. Smirnova, and Kh. A. Abduazimov, Khim. Drev., No. 2, 75 (1976).

---

*Deceased.

Institute of the Chemistry of Plant Substances, Academy of Sciences of the Republic of Uzbekistan, Tashkent, fax (371) 120 64 75. Translated from Khimiya Prirodnykh Soedinenii, No. 6, pp. 833—834, November-December, 1998. Original article submitted January 4, 1998.

0009-3130/98/3406-0743$20.00 ©1998 Kluwer Academic/Plenum Publishers